Soil Report

LE CLERC CREEK GRAZING ALLOTMENT MANAGEMENT PLANNING EIS

Sullivan Lake Ranger District
Colville National Forest

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1.0 – PROJECT DESCRIPTION

1.1 - PURPOSE AND NEED FOR ACTION

1.1.1 - Purpose

The focus of this project is to analyze management of the existing grazing allotment. The purpose of the Le Clerc Creek project is to:

- Provide protection or enhancement of ecosystem values affected by grazing including streams, fisheries habitat, riparian areas, sensitive plant species, terrestrial wildlife habitats, vegetation, and recreation sites;
- Compliance with Section 504 of the 1995 Rescissions Bill (P.L. 104-19); Public Law 104-19, the Rescission Act, was signed into law In July 1995. The Act requires that NEPA analysis be conducted on all range allotments by 2019 and that new permits be issued unless there are significant environmental concerns;
- Analyze whether to continue authorizing grazing in the Le Clerc Creek allotment;
- Update allotment management plans to reflect current laws, regulations and management direction and provide for adaptive management;
- Authorize construction of needed range improvement projects, including fence lines, water developments and related facilities, and the redesign of existing range improvement projects.

1.1.2 - Need

The need for the proposed action is that a qualified applicant would like to continue cattle grazing on this allotment. Management proposals would move the existing condition toward compliance with State Water Quality standards and the Riparian Management Objectives as stated in the Colville National Forest – Land and Resource Management Plan (USDA, 1988). There is also a need to determine what improvements are needed within the allotment, where they are needed, and how to implement the proposals. This includes improving allotment management conditions: improvements of riparian conditions in some areas, review of allotment boundaries, and improve forage quality and quantity.

1.2 – NO ACTION ALTERNATIVE, NO CHANGE ALTERNATIVE, AND PROPOSED ACTION

1.2.1 - Alternative A – Authorize Grazing under Current Management Practices

This alternative would authorize grazing under the existing management plan. There would be no change to existing allotment or pasture boundaries, season of use, and permitted cow/calf pairs – 101. No new improvements would be installed, with the exception of a riparian exclosure on the lower Middle Branch Le Clerc Creek that was planned and approved prior to this project.

1.2.2 - Alternative B - No Grazing

This alternative would close the allotment and terminate the grazing permit. Existing range improvements would be removed as funding becomes available. The Forest Service would attempt to maintain homestead meadows in the area as described with Alternative C.

1.2.3 - Alternative C - Authorize Grazing with Adaptive Management

The objective of this alternative would be to move the existing condition toward compliance with State Water Quality standards and the Riparian Management Objectives prescribed in the Inland Native Fish Strategy (USDA, 1995). Changes to the boundaries, administration, and management of the allotment would occur as detailed in the project record. In summary, the current number of cow/calf pairs would be authorized, the move on and off date would be

delayed two weeks, the Fourth of July Pasture would be removed from the allotment, additional range improvements would be utilized, and monitoring with adaptive management would occur.

1.2.3 – Alternative D – Authorize Grazing with Adaptive Management and Management Changes

The objective of this alternative would be to move the existing condition toward compliance with State Water Quality standards and the Riparian Management Objectives prescribed in the Inland Native Fish Strategy (USDA, 1995). Changes to the boundaries, administration, and management of the allotment would occur as detailed in the project record. It would implement the Alternative C with changes made during collaboration with the current range permittee that would allow for more successful management of the allotment in terms of implementation as well as the protection of sensitive resources.

1.3 – MANAGEMENT AND LEGAL FRAMEWORK

The relevant laws, guidance, and direction for the proposed project in relation to the effects to soil quality, soil productivity, and watershed function are:

- Multiple-Use Sustained Yield Act of 1960
- National Forest Management Act (NFMA) of 1976 (as amended)
- Clean Water Act (CWA) of 1977 and 1982 (as amended)
- Executive Order 11988 (floodplains) - 1977
- Executive Order 11990 (wetlands) - 1977
- General Water Quality – Best Management Practices - 1988
- Colville National Forest Land and Resource Management Plan – 1988
- Forest Service Manual and Handbook Direction 2500 – Watershed and Air Management
- Region 6 - Soil Quality Standards and Soil Quality Guidelines- 1998
- National Best Management Practices for Water Quality Management on Forest System Lands - 2012

1.4 – PROJECT AREA

The project area is located on the Sullivan Lake Ranger District within the West Branch Le Clerc Creek and East Branch Le Clerc Creek HUC 6 Watersheds. The Le Clerc Allotment is three large areas east of the Pend Oreille River, south of Sullivan Lake, west of Monumental Mountain, and north of Ruby Mountain. The Le Clerc Allotment is contained within Township 35, 36, and 37 and Range 43 and 44 across multiple sections.

Region 6 Soil Quality Standards and Guidelines directs that activities do not exceed 20 percent detrimental soil conditions in an activity area. Activity area is defined as "the total area of ground impacting activity, and is a feasible unit for sampling and evaluating" typically a timber sale contract unit. The Le Clerc allotment contains a range of vegetation types and landforms with cattle use varying greatly between them. Some areas get no use by cattle while others areas get higher use rates. For the soil resource and for analysis, the concentrated use areas of the allotment serves as the analysis area. In the Le Clerc Allotment, 14 Concentrated-Use Areas (by cattle) and 40 Wetlands were identified and sampled as described in **Section 2.3.1**, project maps of sampling areas are included in the project files. Shapefiles of the Concentrated-Use Ares and Wetlands are in the project file and report attachments.

The area used for cumulative effects analysis consists of the area inside the Alternative A, Alternative C, and Alternative D allotment boundary.

1.5 – INFORMATION AND FIELDWORK USED FOR ANALYSIS

The project area was evaluated using current soil mapping, geology maps, and topographical maps as well as historical and current aerial imagery. Jason Jimenez, Forest Soil Scientist, spent **5** days in the project area conducting reconnaissance and field surveys in August 2013 and spent **20** days with review of literature, analysis, and report writing. The Soil Crew spent **40** person days in the project area conducting reconnaissance and field surveys in August and September 2013.

The Soil Crew conducted National Soil Disturbance Monitoring Protocol Surveys (on Concentrated Use Areas). Soil compaction was identified by use of a spade to evaluate alteration of soil structure and resistance to penetration. Extent of compaction as well as other detrimental soil conditions is determined through transects, dug soil pits, and use of visual disturbance classes (Page-Dumroese et al. 2009a and Page-Dumroese et al. 2009b). Surveys were conducted at a 70% confidence interval. Due to the high rate of detrimental soil conditions found in Concentrated Use Areas the calculation of the confidence interval was done by using the undisturbed variation in compaction instead of the disturbed variation in compaction. Minimum transect was 30 points. Visual disturbance classes are used are described in Napper et al. 2009. These areas were identified by field reconnaissance, interpretation of recent satellite imagery, and consultation with the range specialist with 14 Concentrated Use Areas identified and surveyed. Results are reported in **Section 2.3.1**.

The Soil Field Crew using the Proper Functioning Condition Protocols (DOI, 2003 and DOI, 1998) conducted a survey of existing mapped wetlands on Forest Service lands within the Proposed Action allotment boundary. Wetlands were also surveyed to determine if they meet criteria to for hydric plants, hydric soils, and wetland hydrology. Due to limited time and funding only wetlands greater than one acre were surveyed. Also due to this limited time and funding, the Soil Field Crew conducted the surveys instead of the Interdisciplinary Team, as the protocol is intended (page 1, DOI, 1998). The Soil Field Crew was trained on the protocol for several days and had backgrounds in soils, wetland ecology, and environmental science. A total of **40** mapped wetlands were surveyed. Three wetlands end up not being within the project area and one has poor access. A total of five mapped wetlands were determined not to possess sufficient hydric soil or obligate wetland vegetation to be determined a wetland; approximately **166** acres of wetland were surveyed. The wetland survey covers all of wetlands greater than one acre on Forest Service land within the Alternative C allotment boundary, except for the **9** detailed above (3 not in the project area, 1 with poor access, and 5 determined not to be wetland). Wetlands on private lands within the project boundary were not surveyed. Results are reported in **Section 2.3.2**.

Current and past scientific literature was used to analyze effects of cattle grazing to the soil resource. Personal knowledge of this area, discussions with other resource specialists, qualitative and quantitative field survey, and professional experience was used to analyze the alternatives and determine effects to soils.

2.0 – EXISTING CONDITION AND THE AFFECTED ENVIRONMENT

2.1 – BACKGROUND

The project planning area consists of the Le Clerc grazing allotment. The National Forest System Lands within the project planning area are the analysis area for this resource. While livestock have access to a larger area, cattle use is more concentrated along roadsides, closed road beds, old landings seeded with palatable grasses, near water in riparian areas and low tree canopy cover areas in the allotment. This analysis will focus on the Concentrated Use Areas within the allotment, where a majority of the use by cattle was observed and soil disturbance data was collected. Other areas in the allotment are assumed due to lower use, to have lower percentages of detrimental soil conditions.

2.2 - SOILS IN THE PROJECT AREA

A soil map is provided in **Appendix I** (USDA, 1992). Four main categories summarize the soils in the project area based on their parent material and distribution of volcanic ash. Volcanic ash content has strong implications for soil productivity and sensitivity to management actions. Soils within the groups have similar properties and implications for management: volcanic ash-capped, admixture, no volcanic ash, and wetlands.

2.2.1 - Volcanic Ash Capped Soils

Soils influenced by volcanic ash dominate the soils in the project area. Cascade volcanoes have deposited volcanic ash across the project area, predominately from Mt. Mazama, now Crater Lake, which deposited approximately six to twelve inches of volcanic ash in eastern Washington and northern Idaho. When volcanic ash was deposited wind and water redistributed the volcanic ash across the landscape. The volcanic ash component is generally silt-size particles and deeper on north aspects, higher elevations, moist vegetation associations, and convex landscape positions. (Page-Dumroese et al. 2007)

About 75% of the project area has volcanic ash-capped soils. In this area, the ash layer generally ranges from 6 inches to 24 inches. The presence of volcanic ash strongly influences many of the management interpretations for these soils. Ash-cap soils have a high water holding capacity, high nutrient holding capacity, lower bulk density, are more productive, and resilient to disturbance compared to most other soils. Volcanic ash capped soils are important to protect as they contribute greatly to soil and tree productivity.

Compaction: Due to fine textures, silts and silt loams in the surface horizons, ash-capped soils have a high potential for compaction.

Erosion: Soils with ash-caps are not highly erodible because the ash forms water stable aggregates and develops very high infiltration rates. When dry, these soils are very dusty and non-cohesive and can be susceptible to wind erosion if large areas of bare soil are exposed. The soil erosion potential for volcanic ash soils is moderate.

2.2.2 – Soils with an Admixture of Volcanic Ash and Other Parent Materials

About 10% of the project area has soils that have an admixture of volcanic ash in the surface horizon. Admixture soils have a high bulk density and greater soil strength than volcanic ash-capped soils. Admixture soils are typically loam or sandy loam surface textures. The coarse fragments in the surface horizons vary considerably among these soils.

Compaction: Because of the higher initial bulk density and the greater soil strength, admixture soils don't compact as easily as ash-cap soils. Compaction potential is typically moderate.

Erosion: These soils do not form the water stable aggregates seen in volcanic ash soils and the erosion potential is high.

2.2.3 – Soils with No Appreciable Volcanic Ash

About 15% of the project area has soils that have no appreciable volcanic ash in the surface horizon. These are typically soils with alluvial, glacial outwash, or glacier lake deposits parent materials.

Compaction: Because of the higher initial bulk density, high rock fragment content, and the greater soil strength, these soils do not compact as easily as volcanic ash-capped soils. Compaction potential is typically low to moderate.

Erosion: On the soils formed in glacier outwash, erosion potential is high due to soils being loose and friable and slope stability can be moderate or low.

2.2.4 - Wetland Soils

Approximately 200 acres or 1% of the approximately 20,000 acre project area consist of mapped hydric soils. The project area has approximately 250 acres of mapped wetlands (including wetlands on private land). There are also

small-unmapped wetlands and seeps scattered throughout the project area. Wetlands are universally sensitive to traffic due to saturation throughout the growing season and high organic matter content. Wetlands are at high risk for detrimental soil conditions. Most wetland soils are mapped as borosaprists, a dark black, saturated soil composed mostly of moderately decomposed organic matter. The depth of the organic layer varies depending on the wetland, but may be as deep as 60 inches.

Compaction: Due to high moisture content across the growing season, wetlands have a very high soil compaction potential. Compaction creates drying conditions and loss of organic matter through oxidation.

Erosion: Wetlands are generally in low gradient and low landform positions and have a low soil erosion potential.

2.3 – AREAS OF CONCERN FOR SOIL RESOURCES

2.3.1 – Concentrated Use Areas

Concentrated Use Areas were identified during reconnaissance surveys, aerial photo interpretation, and discussions with the range specialist. Designated in GIS and modified from ground survey, Concentrated Use Areas are typically low canopy cover areas and dominated by grasses and forbs and typically have access to water. These areas were surveyed using the National Soil Disturbance Monitoring Protocol at a 70% confidence interval. **Table 1** summarizes the results of the surveys. **Appendix II** includes a map with Concentrated Use Areas identified.

Table 1 – Summary of Soil Disturbance Monitoring Protocol

Survey Unit	% Detrimental Soil Condition[1]	Forest Floor Depth (cm)	Acres	Wetland in Concentrated Use Area	Survey Comments
Concentrated Use - 1	3	2.8	3	Y	
Concentrated Use - 2	7	1.6	7	N	
Concentrated Use - 3	90	1.2	3	N	
Concentrated Use - 4	3	1.1	8	N	
Concentrated Use - 5	23	1.9	6	N	
Concentrated Use - 6	10	1.5	6	N	Cow disturbance
Concentrated Use - 7	92	1.5	13	Y	Cow disturbance, Invasive plants
Concentrated Use - 8	97	0.8	5	Y	
Concentrated Use - 9	100	0.6	7	N	Disperse camping, OHV disturbance
Concentrated Use - 10	100	0.8	3	N	Cow disturbance
Concentrated Use - 11	97	1	12	N	Cow disturbance
Concentrated Use - 12	100	2.7	2	N	Heavy compaction
Concentrated Use - 13	0	3.0	2	Y	Undisturbed, no evidence of cows
Concentrated Use - 14	100	0.3	2	N	Cow damage

Notes: [1]Regional and Forest Plan Standards are exceeded above 20% detrimental soil condition, in highlighted rows. Total surveyed detrimental soil conditions are 53 acres of 79 acres of Concentrated Use Areas (66%).

A suitability analysis was completed by the GIS and Range Specialists to determine the approximate acres in the allotment that cattle have the potential to use; Alternative A provides 5,452 acres, Alternative C provides 4,565 acres, and Alternative D provides 5,913 acres. Alternative B is the no grazing alternative and does not provide acres to be utilized by livestock. Approximately 0.9 to 1.2% of the potential areas for utilization by livestock are areas that do not meet Regional and Forest Soil Quality Standards from data collected during field surveys. These areas are typically low

canopy cover areas with hydric soils and grass or shrub forage for livestock. These areas are a low percentage of the landscape and have higher productivities for livestock forage and other services than forested timber stands.

2.3.2 – Wetlands

The project area includes approximately 250 acres of mapped wetlands within the allotment boundary, with many present on private land which were not surveyed. The Colville National Forest wetland layer based on the National Wetland Inventory was used, the wetland layer was cut to the proposed allotment boundary and to Colville National Forest ownership. Since the allotment is not enclosed or wetlands adjacent to the allotment have no physical barriers, I anticipate some use of these features by cattle, use and effects to wetlands outside the project boundary but are assumed not be detrimental. Approximately 160 acres of wetlands, 40 individual wetlands were surveyed using Proper Functioning Condition protocol per Technical Reference 1737-15 (DOI, 2003). Results from proper functioning condition surveys are shown in **Table 2**. **Appendix II** contains a map of the surveyed wetlands.

Table 2 - Summary of Proper Functioning and Condition Wetland Surveys

Wetland	National Wetland Inventory Code	Acres	Condition[1]	Trend[2]	Issues
LC Wet 1	POWHB	1	Not a wetland	--	--
LC Wet 2	PSS1CB	10	Functional - at risk	Downward	Cattle, erosion
LC Wet 4	PSS1C	21	Functional - at risk	Upward	Hydrology
LC Wet 5	PSS1C	3	Proper functioning	--	--
LC Wet 6	PSS1C	9	Functional - at risk	Downward	Hydrology, erosion
LC Wet 7	PEM1C	1	Proper functioning	--	--
LC Wet 8	PEM1C	3	Proper functioning	--	--
LC Wet 9	PEM1C	1	Proper functioning	--	--
LC Wet 10	POWHB	2	Proper functioning	--	--
LC Wet 11	PEM1C	4	Functional - at risk	Downward	Cattle, vegetation
LC Wet 12	POWHB	2	Proper functioning	--	--
LC Wet 13	PSS1C	1	Proper functioning	--	--
LC Wet 14	PSS1C	18	Proper functioning	--	--
LC Wet 15	PEM1C	2	Proper functioning	--	--
LC Wet 16	PSS1C	5	Proper functioning	--	--
LC Wet 17	PSS1C	2	Functional - at risk	Downward	Cattle, hydrology, vegetation
LC Wet 18	PEM1C	1	Proper functioning	--	--
LC Wet 19	PSS1C	1	Proper functioning	--	--
LC Wet 21	PSS1C	6	Functional - at risk	Downward	Cattle
LC Wet 22	POWHB	1	Proper functioning	--	--
LC Wet 24	PSS1C	2	Functional - at risk	Not apparent	Hydrology, vegetation, cattle
LC Wet 25	PEM1F	1	Proper functioning	--	--
LC Wet 26	PSS1C	1	Proper functioning	--	--
LC Wet 28	PSS1C	8	Not a wetland	--	--
LC Wet 29	POWHB	1	Not a wetland	--	--
LC Wet 30	PSS1C	19	Functional - at risk	Not apparent	Cattle
LC Wet 31	PEM1C	1	Proper functioning	--	--
LC Wet 32	PSS1C	6	Proper functioning	--	--

Wetland	National Wetland Inventory Code	Acres	Condition[1]	Trend[2]	Issues
LC Wet 33	PEM1C	3	Functional - at risk	Downward	Cattle, vegetation
LC Wet 35	PEM1C	1	Functional - at risk	Downward	Hydrology, vegetation, cattle
LC Wet 36	PSS1C	8	Functional - at risk	Downward	Hydrology, cattle
LC Wet 37	PSS1C	1	Proper functioning	--	--
LC Wet 38	PEM1C	5	Functional - at risk	Not apparent	Hydrology, vegetation, erosion, cattle
LC Wet 39	PSS1C	1	Not a wetland	--	--
LC Wet 40	PSS1C	1	Not a wetland	--	--
LC Wet 41	PSS1C	4	Proper functioning	--	--
LC Wet 42	PEM1C	3	Proper functioning	--	--
LC Wet 43	PEM1C	3	Proper functioning	--	--
LC Wet 44	PEM1C	1	Functional - at risk	Downward	Hydrology, vegetation, cattle
LC Wet 46	PEM1C	1	Proper functioning	--	--

Notes: [1] Highlighted rows are wetlands that are functional at risk.
[2] Proper functioning and not a wetland are not attributed with a trend.

Of the 40 wetlands surveyed, 22 (55%) were determined to be properly functioning, 13 (33%) wetlands were determined functional at risk (9 downward trend, 1 upward trend, and 3 not apparent), and 5 (13%) were determined not be a wetland. The percentages when not including the not a wetland are 63% properly functioning and 37% functioning at risk. All wetlands with cattle presence or cattle use were determined to be functional at risk with downward or not apparent trends. All wetlands surveyed which did not have use by cattle were rated as properly functioning. All surveys were conducted within the allotment boundary. There is approximately 91 acres of the 160 acres of wetlands surveyed determined to be functioning at risk. This is approximately 57% aerial extent of the wetlands.

A suitability analysis was completed by the GIS and Range Specialists to determine the approximate acres in the allotment that cattle have the potential to use; Alternative A provides 5,452 acres, Alternative C provides 4,565 acres, and Alternative D provides 5,913 acres. Alternative B is the no grazing alternative and does not provide acres to be utilitized by livestock. Approximately 1.5 to 1.9% of the potential areas for utilization by livestock is wetlands that were rated as functional at risk during field surveys. Wetlands provide many ecological services such as wildlife habitat, carbon storage, and improvement of water quality (Cooper and Merritt, 2012) and thus important areas to monitor and manage for proper functioning.

2.3.3 – Road Prisms

The Forest Service considers roads to be land that is taken out of production. The soil productivity is already altered from the road construction, so grazing cattle along roads has negligible effect on the soil productivity for these areas. However, cattle grazing along roads can be problematic where cattle trail up and down road cuts that are either unstable or wet from seeps. This was not extensively observed on the Le Clerc Allotment.

2.3.4 – Dispersed Camping and Off-Highway Vehicle Recreation

Dispersed camping and OHV travel occur sporadically through the project area. Frequently used dispersed campsites and unauthorized roads/OHV trails can be found within the Allotment boundaries. Lightly used dispersed campsites occur throughout the project area on old landings and ends of roads. One large dispersed camping and OHV area was surveyed referred to as Ballpark Meadow – Concentrated-Use Area 9; this area exceeded Regional Soil Quality

Standards being surveyed as having 100% detrimental soil conditions. A majority of the conditions comes from dispersed camping and the OHV use, some of the conditions come from cattle and the historic use of this area.

The effects of dispersed camping on the soil are intense but very spatially limited. The soil in popular campsites is compacted, the litter layer is often gone or very thin, and the soil surface is usually bare of vegetation

2.3.5 – Timber Harvest

Timber harvest is the most widespread activity in the area. Cattle grazing of past timber harvest was not widely observed; Harvest has resulted in a large number of old roads and skid trails, some of which cattle and OHVs will continue to use. Past sampling of harvested areas in the Hanlon project area and Scotchman project area found detrimental soil conditions in harvest units with the vast majority was less than 10%. Recent timber harvest has increased detrimental soil conditions but within Regional and Forest Soil Quality Standards.

2.3.6 – Fire

Large stand replacing fires burned in the allotment boundary in the late 1920s and early 1930s. This has resulted in the densely stocked stands of small diameter trees. However, since large fires have not recently occurred in the action area and current forest canopies are dense, the effect of historic fire on the soil resources appears minor; soil resources have recovered and stabilized from potential fire damage caused by the fires in 1920s and 1930s.

3.0 – Soil Design Elements and Best Management Practices

Both the regional and forest plan standards were designed with a focus on timber harvest, guidance pertaining to grazing permits or the management of range allotment are minimal or inferred from the standards and Forest Service Manuals and Handbooks.

3.1 – Region 6 - Soil Quality Standards and Guidelines

The following Regional Soil Standards and Guidelines are thresholds beyond which soil quality and soil productivity are adversely impacted. A minimum of 80% of an activity area is required to be in in acceptable soil quality condition (USDA, 1998). Recognizing that some activities impact soil productivity, the Forest Service policy is to limit the extent of detrimental impacts. The Pacific Northwest Regional policy emphasizes protection over restoration.

Detrimental soil conditions (DSC) and the accompanying criteria for determining these conditions include:

- **Detrimental Compaction** – An increase in soil bulk density of 20% or more over an undisturbed level in volcanic ash soils or an increase in soil bulk density of 15% or more over an undisturbed level in non-volcanic ash soils.
- **Displacement Puddling** – When the depth of ruts or imprints is six inches or more, soil deformation and loss of structure are observable and bulk density is increased.
- **Detrimental Displacement** – The removal of more than 50% of the topsoil from an area greater than 100 square feet, which is at least five feet wide.
- **Detrimental Burning** – When the mineral soil surface has been significantly changed in color, oxidized to a reddish color, and the next one-half inch blackened from organic matter charring by the heat conducted through the top layer, applies to an area greater than 100 square feet, at least five feet wide.
- **Detrimental Surface Erosion** – Evidence of surface soil loss in areas greater than 100 square feet, rills, gullies, and/or water quality degradations from sediment.
- **Detrimental Mass Wasting** – Evidence of landslide associated with land management activities or degrades water quality.

- **Organic Matter** – Maintained in amounts sufficient to prevent short or long-term nutrient and carbon cycle deficits and to avoid detrimental physical and biological conditions. (1) Fine Organic Matter – plant litter, duff, and woody material less than three inches in diameter. (2) Coarse Woody Material – woody material greater than three inches in diameter.
- **Changes in Soil Moisture Regime** – Soil moisture regime remains unchanged. Detrimental conditions are changes in soil drainage classes or aquic conditions that are incompatible with management objectives.

3.2 – COLVILLE NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN

In addition to the Regional Soil Quality Standard of less than 20% detrimental soil condition, the Colville National Forest Land and Resource Management Plan (Forest Plan) provides three additional soil standards (USDA, 1988):

- Skid trail requirements must be specified in timber sale contracts that require tractor yarding.
- Identify areas of high soil erosion or mass failure potential and evaluate probable impacts of resource development.
- Retain organic matter to maintain site productivity.

3.3 - BEST MANAGEMENT PRACTICES

Best management practices (BMP's) designed to protect water and soil quality are derived from General Water Quality – Best Management Practices, Pacific Northwest Region (USDA, 1988) and the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA, 2012) and are incorporated by reference.

BMP's protect the beneficial uses of water, soil productivity, and soil quality. BMP's also prevent or minimize the threat of discharge of pollutants. Similar projects have used BMP's in the past and been proven effective in protecting water and soil quality as well as soil productivity. BMP's that should be used include Range-1, Range-2, and Range-3.

4.0 – ENVIRONMENTAL EFFECTS TO SOILS

Slope stability and potentials for landslides will not be measurably affected by either the presence or absence of cattle grazing in the Le Clerc allotment due to lack of cattle grazing on steep slopes, lack of utilization of large woody vegetation, and the geology/parent materials in the allotment. Slope stability will not be addressed further in the analysis.

Alternative A and Alternative C will have effects that are very similar except for the changes to management detailed in Alternative C. Effects for these two alternatives are described in the section below. With adaptive management the detrimental effects to soils and wetlands can be lessened through management that disperses and reduces cattle impacts to soils and wetlands.

4.1 –EFFECTS COMMON FOR ALTERNATIVE A, ALTERNATIVE C, AND ALTERNATIVE D

4.1.1 - Soil Hydrologic Function

Grazing in the allotment has been ongoing in the project area for over 70 years, with grazing of cattle by homesteaders beginning in the 1900's. Potential impacts from historic and current grazing include an increase in soil bulk density (soil compaction) from cattle use in concentrated areas resulting in decreased infiltration rates and increases in erosion rates.

Soil compaction and displacement by hoof action can lead to the dislodging of plants, changes in soil structure and porosity, and a loss of productivity. Compaction and displacement occurs in several areas of cattle use including forage areas, trailing sites, and rest sites (Krzix et al, 1999). Compaction changes the soil structure, decreasing available refugia for soil organisms, reducing the rate of water/nutrient infiltration, and diminishing water storage capacity (Belsky and Blumenthol 1997 and Naeth et. al. 1990). Lower soil moisture contents in turn reduce plant productivity and vegetative cover that further degrades both the plant community and soil structure. Detrimental soil conditions of compaction/displacement in meadow, wetland, and riparian areas will affect soil productivity (Donkor et al, 2002).

Cattle use of forested upland areas is generally very light. Continued grazing would have little impact in these areas. If cattle are successfully drawn into the more open uplands by improved water developments and management, as planned, grazing intensity of the uplands would increase. This would cause increased compaction in the form of trailing on dry ground to, near, and between troughs, and may cause very small areas of localized erosion. The extent of compacted soil in new trails would be small at a landscape scale and effects on soil productivity would be negligible. Protection of riparian and wetlands would be beneficial from directing grazing to upland areas.

Cattle would continue to graze along roadsides, especially roadsides seeded to palatable grasses. Since the roadside grazing is limited to cut and fill slopes, the effects on site-productivity would be very limited. Where cattle trail up and down sandy road cuts, localized erosion would continue.

4.1.2 - Nutrient Cycling, Filtering and Buffering, and Carbon Storage

Many studies have found that cattle grazing reduce soil organic layers (litter and duff) (Belsky and Blumenthol 1997, Irwin et. al. 1994). Cattle trampling scuffs away litter layer and organic matter, or can reduce soil organic matter content and reduce macroporosity (increases compaction), consequently reducing water infiltration and air diffusion, increasing runoff, creating soil erosion and sedimentation. Cattle impacts on vegetation can also include indirect effects of trampling and soil compaction, removal of small stems in the shrub and sapling layer, and damage of larger trees. Bezkorowajnyj and others (1993) found that nitrogen uptake by saplings was decreased in areas compacted by grazing. Tree roots are more frequently exposed in heavily used areas than in unused areas. Heavily used areas experience progressive expansion of detrimental soil conditions.

Other less obvious impacts can occur, including changes in soil chemical parameters such as soil organic carbon and nitrogen. Ganjegunte and others (2005) found that light grazing increased soil organic carbon and nitrogen compared with heavy grazing and exclosures (no grazing). Hamilton and others (2008) found increased root exudation in Kentucky bluegrass when plants were defoliated, which led to an increase in nitrogen mineralization. The authors conclude that changes in short-term rhizosphere processes as a result of defoliation play an important role in carbon and nitrogen transformations in grazed lands. It has been found that grazing by large domestic ungulates increases nitrogen loss through ammonia volatilization (Irwin et. el. 1994). Light and heavy grazing stimulates the transfer of carbon and nitrogen from the above ground plants to the soil (Schuman et al. 1999). These sites may suffer unnatural litter production from annual grasses, loss of below ground organic matter accumulation, and altered below ground nutrient cycling regimes (Ehrenfield 2003).

4.1.3 - Wetlands

Increasing cattle use of uplands should decrease the intensity of impacts along streams, wetlands, and Concentrated Use areas. However, with continued grazing, impacts such as punching and chiseling of wetland soil and compaction will continue. From field surveys and site specific data collection, approximately 40% of wetlands will continue to

degrade until wetlands that are functioning at risk are excluded from cattle use or cattle use is limited from a reduction in stocking rates.

4.1.4 – Changes with Alternative C

The below section covers the effects of adaptive management and changes in grazing management from Alternative C to soil resources.

1. Implement Adaptive Management including a Monitoring Plan – implementation could benefit soil resources through management based on data collected and standards implemented. The potential for reduced cattle presence in sensitive ecological areas (wetlands and riparian areas) will reduce detrimental soil conditions and assist in vegetation recovery.

2. Cattle Numbers – Current cattle numbers have contributed to issues with detrimental soil conditions and moved several wetlands into functioning at risk conditions as documented in field surveys, data collection, and photos conducted by the Soil Field Crew in August and September of 2013. The ability to change cattle numbers depending on monitoring and vegetation conditions would be beneficial to soil resources and wetland function.

3. Timing of Grazing – The turn-on date moving two weeks later would be beneficial for soil resources; soils would potentially contain less moisture and have less potential for detrimental compaction. Additional growing season for plants to establish and provide soil cover would also be beneficial for soil resources in the allotment.

4. Allotment/Pasture Boundary Changes - Removing the Fourth of July Pasture will be beneficial. Detrimental soil conditions in the pasture would slowly recover with freeze/thaw and biological activity. Wetlands that are functional at risk and Riparian Areas that are impacted by concentrated cattle use would recover with the subsequent vegetation recovery. Changes to the Lower Bunchgrass Pasture will improve soil and vegetation conditions in areas excluded. Additions to the allotment lack any sensitive soil or wetland features and will assist in the overall management of the allotment which will maintain or reduce detrimental soil conditions. Other proposed changes would not have detrimental impacts to soil resources; having reviewed the areas no issues concerning soils or wetlands were discovered with these other changes in allotment boundaries.

5. Range Improvements - including trough and fence installation as well as other physical structures will cause no measurable increases in detrimental soil conditions. New troughs or new locations of existing troughs would cause a small area around the trough to become compacted and bare but not substantial affect soil resources. No soil design elements are needed for the construction of range improvements including the installation of harden crosses. National Forest Service Best Management Practices are sufficient to protect soil resources.

6. Access Road - The new access route to Hanlon Meadow would be used on an existing road template, with the obliteration of the existing road would give a net benefit to soil resources.

4.1.4 – Changes with Alternative D

This alternative would be a modification of Alternative C. Alternative D would incorporate all of the elements of Alternative C with the following changes:

1. The Hanlon Meadow that is currently not identified within the proposed action would be identified as a pasture within the allotment and would be monitored to standards. Once grazing standards have been reached, cattle

would be removed from Hanlon Meadow. Hanlon meadow pasture would be used for a short duration holding of cattle during gathering.

2. The proposed fence around the NW corner of T36N R44E S21 would be dropped.

3. The SE allotment/pasture boundary would be adjusted from the Middle Branch Le Clerc Creek to the existing fence along the East Branch road (FR 1934) as shown on the map. There would be a new fence constructed adjoining the existing fence along the East Branch Road North along the creek, outside of the RHCA management zone and would tie into topography or vegetation to help restrict cattle movement south around Section 13.

4. Fencing would be constructed and/or natural barriers would be used on the east side of Middle Branch Le Clerc Creek in T36N R45E S16 and S20 to exclude cattle from Middle Branch Le Clerc Creek.

5. The southern allotment boundary would be adjusted in T36N R44E S29 NE1/4 to include the shrub wetland south of the holding pen in the allotment.

6. Construct new fence to connect two existing fences together creating an effective barrier to cattle drift in the NW ¼ of T36N R44E S20.

7. Modify the northern allotment boundary to include an area of upper Paupac.

8. Install two cattle guards (one on 1936 and one on 1936010 sec 25).

9. Construct a short drift fence across the 1933141 road to reduce cattle drift out of the Dry Canyon pasture onto private lands (this is a system road but is ML1).

10. Additional drift fence in T36N R44E S06 to further eliminate drift to private lands.

With these changes to Alternative D, there would be no substantial direct effects to the soil resource or wetlands due to the implementation of these modifications.

4.1.5 – Effects of Implementation of Adaptive Management to the Soil Resource and Wetlands

The effects of implementation of adaptive management to the soil resource and wetlands can be categorized as direct: the effects the construction of fences, cattle guards, and other infrastructure to soils and wetland and indirect: the effect that those management actions introduce to the cattle movement and cattle impacts to the soil resource and wetlands. Any monitoring or data collection done for adaptive management will not affect the soil resource or wetlands.

The direct disturbance to soil from the construction of fences and cattle guards is minimal and does not pose a threat to Forest and Regional Soil Quality Guidelines. The work affecting soil included digging small holes less than one cubic yard for fence posts or native vegetation planting to large holes greater than one cubic yard for cattle guards and armoring water crossings, driving posts, and cross country travel for the running of fence wire or water lines. Soil disturbance is localized and not extensive for any of the infrastructure projects. None of the projects will have landscape scale effects from their implementation. There will be soil disturbance in the short-term but not to any

extent of substance that would detrimentally affect soil or soil processes. Due to the indirect effects of these infrastructure improves these projects would have beneficial effect to the soil resource.

The indirect effects from these changes include more dispersed cattle use and the changing of cattle movement across the landscape. The adaptive management should in the short and long term reduce impacts of cattle concentrating in riparian areas and wetlands. Soil cover and the extent of cattle punching and chiseling should improve. Cattle use and concentrations should be spread out on the landscape to a greater extent. These changes should allow for recovery of soil resources and soil processes in the short and long term. There will be some small areas of increased soil disturbance from cattle concentrations area troughs and water crosses, although overall the soil resource across the landscape will benefit from less cattle use in more sensitive areas.

The direct effects of reducing livestock number and/or reduced grazing season would be beneficial to the soil resource and soil processes. Concentrated use areas determined by field survey to exceed Forest and Regional Soil Quality Standards have a potential for recovery of soil compaction in the long term, greater than 10 years. Wetlands that are documented functional at risk or have a downward trend have a potential for upward trends in functioning. Areas of low ground cover have the potential for increasing ground cover. Indirect effects of this adaptive management would not change landscape scale soil processes or detrimentally affect the soil resource.
The potential adaptive management strategies would not contribute to detrimental cumulative effects to the soil resource or soil processes. These potential adaptive management strategies would not create detrimental soil conditions that exceed Forest and Regional Soil Quality Standards and Guidelines.

4.2 – EFFECTS OF ALTERNATIVE B – NO ACTION (NO GRAZING)

4.2.1 - Soil Hydrologic Function

Eventually, soil cover would increase and erosion rates would decrease. Structure would improve and a greater proportion of precipitation would enter the soil and be stored in the soil on the watershed. However, these changes depend on improving structure and pore space distribution, which is biologically mediated and would occur only after soil organic matter increases and trampling effects are ameliorated. Soil functions probably could return to near reference conditions within 20-50 years, though actual change would rely on climate, vegetation, and soil characteristics which would be variable.

Removing cattle from the allotment would remove the ongoing impact of trampling and trailing on sensitive soils. In some areas, the reestablishment of vegetation on bare soil areas would occur within the first year or two. In most other areas, several years or longer would be needed to reestablish vegetation. Compacted moist swales and loafing areas would very slowly start to recover their porosity as vegetation slowly becomes established and root systems and soil organisms increase. Researchers have found a large range of recovery times for grazing-compacted soils from two years to ten years (Talbott-Williams, 2005).

Detrimental soil disturbance would be expected to decline from the existing surveyed results, therefore meeting the Forest Plan and Region Soil Quality Standards in the Concentrated Use Areas Surveyed in the long term.

4.2.2 - Nutrient Cycling, Filtering and Buffering, and Carbon Storage

Nutrient cycling, filtering and buffering, and carbon storage would be improved by the removal of grazing from the allotment. Scientific literature shows that these processes are affected by grazing (Talbott-Williams, 2005). Recovery to

background conditions would begin and continue for decades in Concentrated Use Areas. Transitional range areas would not be affected as they receive minor cattle use.

4.2.3 - Wetlands

Wetlands that were surveyed as functional – at risk with a non-apparent or downward trend would slowly recover and become functional with the exception of wetlands which cattle use has altered the hydrology. Additional restoration will be needed to bring several of the wetlands to properly functioning condition. Wetlands that are properly functioning would continue on that trend.

4.2.4 - Other Soil Resource Issues

Riparian and wetland plant cover and litter would increase, and the rate of organic matter accumulation in the soil would likely slowly increase. Disturbed stream banks would continue to erode in the short term, but would slowly stabilize either because of increased vegetative cover or because they would reach a new equilibrium.

4.4 – CUMULATIVE EFFECTS

4.4.1 – Bounding of the Cumulative Effects

Area - In general, effects on soil productivity are site specific and are not disturbed over the entire analysis area. The analysis area for cumulative effects to soils is the treatment unit or activity area. The activity area as defined in Region 6 Soil Quality Standards as "The total area of ground impacting activity, and is a feasible unit for sampling and evaluating." These areas would be the surveyed Concentrated Use Areas and Wetlands. The effects of past, present, and reasonably foreseeable future actions to soils typically involve the area of disturbance itself and does not move outside the area disturbed. The development and movement of soils occurs on a geologic time scale and this area bounding reflects cumulative effects to soils.

Time - The time bounding for cumulative effects encompasses previous disturbances from prior wildfire, timber harvest, and grazing as detailed in the existing condition. Disturbance to soil can last for decades and even centuries (Amundson & Jenny, 1997). For reasonably foreseeable future actions, the bounding is five years in the future. No additional projects and treatments in addition to the proposed action would have large scale, detrimental effects of soil resources or wetlands are anticipated within the activity area. Continued cattle grazing, road maintenance, and recreational activities are anticipated to be the reasonably foreseeable future events.

4.4.2 – Past Activities

Effects of past and present activities are discussed in the Existing Condition – **Section 2.0** of this report. The existing condition described in the analysis incorporates all past actions that have occurred within the analysis area.

4.4.3 – Reasonably Foreseeable Future Activities

A list of reasonably foreseeable future actions can be found in the project file. The list includes various road restoration, culvert replacements, reforestation, pre-commercial thinning, commercial thinning, and prescribed fire.

Vegetation Management Projects - Le Clerc Creek grazing allotment area is part of the ongoing Scotchman and Hanlon Stewardship Projects. There are approximately 50 timber harvest units within or adjacent to the allotment. These projects involve both commercial and non-commercial timber harvest and prescribed fire, and may include road construction and decommissioning. Timber harvest creates skid trails that are often used preferentially by cattle and wildlife as travel routes. Cattle use on old skid trails compacts them further, but only a portion of the skid trail. Skid trails are already considered to be detrimentally compacted and in process of recovery, so this does not increase the extent of detrimental compaction. The main effect of cattle use of skid trails is the slowed recovery of vegetative cover on the trail and very slight localized erosion where the soil remains bare. This does not constitute an appreciable impact on soil productivity or increases to detrimental soil conditions or cause measurable cumulative effects.

Roads - Ongoing road maintenance has negligible effects on soil productivity. Ongoing grazing along roads and at stream crossings would continue to cause maintenance problems where culverts are plugged or damaged by trampling and wallowing.

Recreation - Motorized Vehicle Use: If all applicable rules regarding motorized recreation are followed, soil disturbance should be minimal. Unauthorized motorized use off roads and trails does impact soil and can be a problem particularly in wet areas that may already be impacted by cattle. Some unauthorized OHV use occurs in the project area but not to the extent that exceeds Regional Soil Quality Guidelines. Pioneered OHV trails can become

established cattle trails and the combined cattle and vehicle traffic prevent the trails from fading back into the landscape. This is problematic in sensitive riparian and wetland areas.

4.4.5 – Cumulative Effects of Alternative A – No Change, Alternative C – Proposed Action with Adaptive Management, and Alternative D

There are no adverse cumulative effects to soil resources if Alternative A, C, or D is selected.

4.4.4 – Cumulative Effects of Alterative B – No Action (No Grazing)

The removal of cattle from the allotment is not expected to contribute to cumulative effects to the soil when combined with past, on-going, or reasonably foreseeable actions. Effects of cattle grazing on soils would slowly be remediated over time by freeze-thaw and soil biological activity.

5.0 - SUMMARY FOR DECISION MAKER

Alternative A

This alternative would not result in improvements in soil condition and may further degrade soil conditions in Concentrated Use Areas. Lack of cattle distribution practices and other range improvements than other alternatives increases the overall impacts from cattle grazing. Wetland function in many wetlands would continue to decline.

Alternative B

This alternative would produce the most rapid improvement in the grazing allotment where past activities have resulted in varying degrees of soil disturbance. Detrimental soil conditions in Concentrated Use Areas would slowly improve as well as wetland function in downward trending wetlands. Alternative B would provide the most protection and recovery of soil quality and soil function as well as wetland function in downward trending wetlands.

Alternative C and Alternative D

Changes in the grazing scheme would move towards improved soil conditions. The increased cattle distribution practices would discourage cattle concentration in areas, potentially current Concentrated Use Areas. This combined with the more range improvements for better cattle distribution would allow more of an opportunity for natural soil processes to work towards improvement in Concentrated Use Areas and Wetlands. The changes in the grazing are steps in the right direction for the recovery of wetlands and detrimental soil conditions but without more intensive management and a decrease intensity and duration of grazing in concentrated used areas and wetlands; Alternative C and Alternative D will be similar to Alternative A.

Surveys found less than 1% of the total area in the allotment boundary detrimentally disturbed, although surveys found that a large majority of the areas of the allotment do not receive cattle use. The allotment boundary is not an appropriate bounding for determining detrimental soils conditions for Regional and Forest Plan Soil Quality Standards. A majority of the identified Concentrated Use Areas did not meet Regional and Forest Plan Soil Quality Standards. Although only small areas are above Soil Quality Standards (a total of 53 acres) or rated as functional at risk (a total of 91 acres), these features are important functional features on the landscape: grassland features and wetlands. These functional features are important for water quality, wildlife habitat, and carbon storage and should meet Regional and Forest Plan Soil Quality Standards and currently do not.

6.0 – CONCLUSIONS AND RECOMMENDATIONS

The proposed project action should comply with the standards and guidelines described in the Forest Service Manual and Handbook, General Water Quality - Best Management Practices – Pacific Northwest Region (1988), Region 6 Soil Quality Standards (1998), and Colville National Forest – Land and Resource Management Plan (1988).
It is my determination that the Alternative A – No Change, Alternative C - Proposed Action with Adaptive Management, and Alternative D will continue to degrade soils within Concentrated-Use Areas and Wetlands rated at Functional at Risk within the Allotment Boundary. There are 9 Concentrated-Use Areas (a total of 53 acres) of the 14 Concentrated-Use Areas identified would continue to exceed Regional Soil Quality Standards and have a high potential to further degrade and expand in size. A majority of the wetlands impacted by cattle would continue to degrade and are at risk for becoming non-functional without cattle exclusion or restoration of some kind. Alternative C and Alternative D has potential to protect soil and water resources if adaptive management is used to protect areas identified as exceeding Regional Soil Quality Standards or as determined as functional at risk.

For the protection of soil resources and wetland function Alternative B – No Action would provide the most protection of soil function in Concentrated Use Areas and the protection of wetland function. Without cattle use and impacts, Concentrated Use Areas and Wetlands would recover detrimental soil conditions and wetland function would improve.

This analysis and report represents my best professional judgment based on data collection and observations of the project area, consultation with other soil scientists and resource professionals, and a review of the best available scientific information. The project file contains fieldsheets, fieldnotes, photos, survey maps, and additional analysis. All references used are available in an electronic format.

3/18/2015

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